Natural Analogs	Natural geologic systems that parallel situations that can develop in man-made systems, in which the formation and transport of minerals over hundreds of thousands and millions of years can be studied directly. An example of natural analog is the natural reactor studied at the Oklo uranium deposit in Gabon, Africa, which can be used as a source of analog data for conceptual models of criticality.
Near Field	The area and conditions within the repository including the drifts and waste packages and the rock immediately surrounding the drifts. The region around the repository where the natural hydrogeologic system has been significantly impacted by the excavation of the repository and the emplacement of waste.
Near-Field Geochemical Environment Model	A model that focuses on major-element geochemistry within the potential emplacement drifts. The boundary of the model domain is defined as the drift wall. This model includes coupling to thermohydrologic processes.
Net Infiltration	The water that has infiltrated down from the soil zone or exposed rock surface to a depth below which it cannot be removed by evapotranspiration. The amount of water that is net infiltration is the total infiltration at the surface minus water lost to evaporation and plant transpiration.
Neutron Absorber	A material such as boron or gadolinium that is placed in a radioactive waste package and that absorbs neutrons to reduce ionizing radiation and to help reduce the likelihood of criticality.
Node	A junction point in a network.
Nominal Case	The case, or conceptual model, representing the expected conditions of the disposal system as perturbed only by the presence of the repository, in the absence of disruptive events.
Nominal Conditions	The site conditions, including features and processes, which are expected, based on current site knowledge.
Nominal Behavior	(1) Expected behavior of the system as perturbed only by the presence of the repository. (2) Behavior of the system in the absence of disruptive events.
Nominal Features, Events, and Processes	Those features, events and processes expected, given the site conditions as described from current site characterization information.
Nonequilibrium Thermodynamics	The study of heat flow systems that have not stabilized (i.e., are not in equilibrium).
Nuclear Chain Reaction	A process in which some of the neutrons released in one fission event cause other fissions.

Nuclear Regulatory Commission (NRC)	Promulgates technical regulations that are consistent with standards established by the U.S. Environmental Protection Agency (EPA) and considers license applications from the U.S. Department of Energy for a proposed repository. It determines, with reasonable assurance, whether EPA standards can be met. It also has the continuing regulatory responsibility to oversee repository operation. NRC was formed by the Atomic Energy Commission with the 1974 Energy Reorganization Act, Public Law 93-438.
Nuclear Regulatory Commission Radioactive Waste Program Annual Progress Report	A status report made each fiscal year that documents the technical work performed on 10 key technical issues that are most important to performance of the proposed geologic repository at Yucca Mountain.
Nuclear Waste Policy (42 USC 10101 et seq.)	The federal statute enacted in 1982 that established the Office of Civilian Radioactive Waste Management (OCRWM) and defined its mission to develop a federal system for the management and geologic disposal of commercial spent nuclear fuel and other high-level radioactive wastes. The Act also: (i) specified other federal responsibilities for nuclear waste management, (ii) established the Nuclear Waste Fund to cover the cost of geologic disposal, (iii) authorized interim storage under certain circumstances, and (iv) defined interactions between Federal agencies and the states, local governments, and Indian tribes. The act was substantially amended in 1987 and 1992.
Nuclear Waste Policy Amendments Act of 1987, Public Law 100-203	Legislation that amended the Nuclear Waste Policy Act to: (i) limit repository site characterization activities to Yucca Mountain, Nevada, (ii) establish the Office of the Nuclear Waste Negotiator to seek a state or Indian tribe willing to host a repository or monitored retrievable storage facility, (iii) create the Nuclear Waste Technical Review Board, and (iv) increase state and local government participation in the waste management program.
Nuclear Waste Technical Review Board	An independent body established within the executive branch, created by the Nuclear Waste Policy Amendments Act of 1987 to evaluate the technical and scientific validity of activities undertaken by the U.S. Department of Energy, including site characterization activities and activities relating to the packaging or transportation of high-level radioactive waste or spent nuclear fuel. Members of this Board are appointed by the President from a list composed by the National Academy of Sciences.
NUFT Computer Code	A computer code that simulates three-dimensional flow of groundwater, heat, and contaminants in unsaturated and saturated porous and fractured media. It is named for Non-isothermal Unsaturated Flow and Transport and is used for drift scale, thermal-hydrologic calculations.

Numerical Model	An approximate representation of a mathematical model that is constructed using a numerical description method, such as finite volumes, finite differences, or finite elements. A numerical model is typically represented by a series of program statements that are executed on a computer.
Office of Civilian Radioactive Waste Management (OCRWM)	A U.S. Department of Energy office created by the Nuclear Waste Policy Act of 1982 to implement the responsibilities assigned by the Act.
One-Dimensional Model	A model that represents physical conditions and/or processes by a vertical column composed of a stack of single grid cells or by a horizontal row of single grid cells.
Order of Magnitude	A range of numbers extending from some value to ten times that value.
Outer Barrier	The outer layer of the two-layer metallic disposal container. It consists of carbon steel, which is a corrosion allowance material.
Outer Barrier and Inner Barrier Corrosion Models	See Corrosion Models.
Outer Barrier Corrosion Model	See Outer Barrier and Inner Barrier Corrosion Models.
Overburden	Geologic material of any nature, consolidated or unconsolidated, that overlies a deposit of useful materials. As used by the Yucca Mountain Site Characterization Project, this is geologic material overlying the mined repository horizon.
Oxidation	(1) A chemical reaction, such as the rusting of iron, that increases the oxygen content of a substance. (2) A reaction in which the valence of an element or compound is increased as a result of losing electrons.
Oxidation State	For an ion, expressed as a positive or negative number representing the ionic or effective charge.
Oxidize	(1) To increase the oxygen content of a substance. (2) To increase the valence of an element or compound as a result of losing electrons.
Paleoclimates	The climate of a past interval of geologic time.
Parameter	Data, or values, that are input to computer codes for a TSPA calculation.
Passive Institutional Control	From 40 CFR 191, methods of preserving information about the location, design and contents of the repository system. These include permanent markers placed around the disposal site area, public records and archives, government ownership, and regulations controlling use of land.

Patch	For corrosion modeling, one of two geometries for an opening in a waste package layer created by corrosion (the other geometry is a pit). A patch is generally wider than it is deep.
Pathway	A potential route by which radionuclides might reach the accessible environment and pose a threat to humans.
Peer Review Panel	A panel of individuals—independent of those who performed the TSPA-VA but who have technical expertise at least equivalent to those who performed the original work—who produce a documented critical review of the work.
Percentile	See Section A.2 of this glossary.
Perched Water	A saturated condition that is not continuous with the water table, because there is an impervious or semipervious layer underlying the perched zone or a fault zone that creates a barrier to water movement and perches water.
Percolation	The passage of a liquid through a porous substance. In rock or soil it is the movement of water through the interstices and pores under hydrostatic pressure and the influence of gravity. The downward or lateral flow of water that becomes net infiltration in the unsaturated zone.
Percolation Flux	Volumetric percolation rate per unit area. The flux anywhere below the root zone of plants and is no longer susceptible to removal back into the atmosphere by evapotranspiration.
Percolation Rate	See percolation flux.
Performance Assessment	An analysis that predicts the behavior of a system or system component under a given set of constant and/or transient conditions. Performance assessments will include estimates of the effects of uncertainties in data and modeling. See TSPA.
Permeability	In general terms, the capacity of a medium like rock, sediment, or soil to transmit liquid or gas. Permeability depends on the substance transmitted (oil, air, water, etc.) and on the size and shape of the pores, joints, and fractures in the medium and the manner in which they are interconnected. "Hydraulic conductivity" has replaced "permeability" in technical discussions relating to groundwater. See also Relative Permeability.
pH	A number indicating the acidity or alkalinity of a solution. A pH of 7 indicates a neutral solution. Lower pH values indicate more acidic solutions while higher pH values indicate alkaline solutions.

Phase	A physically distinct portion of matter, such as the aqueous, gas, or solid phase.
Phase Equilibria	The relationships between phases of a substance undergoing a phase change, such as from solid to liquid, under various conditions of temperature and pressure.
Phase Stability	A measure of the ability of matter to remain in a given phase.
Pit	For corrosion modeling, one of two geometries for an opening in a waste package layer created by corrosion (the other geometry is a patch). A pit is generally deeper than it is wide.
Pitting Corrosion	A type of localized corrosion that forms in indentations called pits.
Pitting Factor	A factor that is used to measure local variations of general, or uniform, corrosion penetration from corrosion allowance materials such as carbon steel.
Playa	The shallow central basin of a desert plain in which water gathers after a rain and then evaporates.
Plume	A measurable discharge of a contaminant, such as radionuclides, from a point of origin. The contaminants are usually moving in groundwater, and the plume may be defined by chemical concentration gradients.
Pluvial	(1) In climatology, relating to former periods of abundant rains, especially in reference to glacial periods. (2) In geology, said of a geologic episode, change, process, deposit, or feature caused by the action or effects of rain.
Point Loading Thermal Design	An emplacement drift design in which commercial spent nuclear fuel waste packages are spaced away from each other along the drift using emplacement drift spacing similar to the commercial spent nuclear fuel-package spacing.
Pore Fluid	The water and any material it is carrying that exist in the pore spaces of the rock matrix.
Pore Waters	Interstitial water, or subsurface water in the pores in rock or soil.
Porosity	The ratio of openings, or voids, to the total volume of a soil or rock expressed as a decimal fraction or as a percentage. See also Effective Porosity.
Pour Canister	A metallic canister into which high-level radioactive waste mixed with molten glass-making materials is poured. The material cools and solidifies in the pour canister.

Precipitate	A substance that separates as solid particles from a liquid as a result of physical or chemical changes.
Precipitation	(1) The process of depositing a substance from a solution, by the action of gravity or by a chemical reaction. (2) Any form of water particles, such as frozen water in snow or ice crystals, or liquid water in raindrops or drizzle, that fall from clouds in the atmosphere and reaches the earth's surface. (3) An amount of water that has fallen at a given point over a specified period of time, measured by a rain gauge.
Probabilistic	(1) Based on or subject to probability. (2) Involving a variate, such as temperature or porosity. At each instance of time, the variate may take on any of the values of a specified set with a certain probability. Data from a probabilistic process is an ordered set of observations, each of which is one item from a probability distribution.
Probabilistic Risk Assessment	(1) A systematic process of identifying and quantifying the consequences of scenarios that could cause a release of radioactive materials to the environment. (2) Using predictable behavior to define the performance of natural, geologic, human, and engineered systems for thousands of years into the future using probability distributions (see Section A.2 of this glossary).
Probability	See Section A.2 of this glossary.
Probability Density Function	See Section A.2 of this glossary.
Probability Distribution	See Section A.2 of this glossary.
Probability Model	A model that quantifies uncertainties in the model parameters and predicts the likelihood of the scenarios used for the model.
Probable Behavior	A combination of the concept of predicted future behavior of the various system components with the uncertainty associated with the prediction.
Process Model	A depiction or representation of a process along with any hypotheses required to describe or to explain the process.
Processes	Phenomena and activities that have gradual, continuous interactions with the system being modeled.
Pyroclastic Flow	A flow of detrital volcanic materials that have been explosively ejected from a volcanic vent. The flow is generally a dense cloud of incandescent volcanic glass, in a semimolten or viscous state, that solidifies into rock. The rock that results is chiefly a fine-grained rhyolitic tuff formed of glass shards that may be welded or nonwelded.
Quantitative	A variable that is expressed numerically.

Quality Factor	The modifying factor that is used to derive dose equivalent from absorbed dose.
Quasi-Static Thermodynamic Processes	Reversible processes resulting in a change to system or body.
Quasi-Transient	Describing the diffusive mass transport model. This means the solution used in the model incorporates steady-state diffusive mass transfer through the perforations of the failed waste container. This is combined with transient mass transfer through the spherical shell of the invert surrounding the waste container. The quasi-transient mass transfer model is used to calculate diffusive release of radionuclides at the engineered barrier system edge.
Rad	The unit of measure for the absorbed dose of radiation. Rad is short for radiation absorbed dose.
Radiation	Ionizing radiation.
Radioactive Decay	The process in which one radionuclide spontaneously transforms into one or more different radionuclides, which are called daughter radionuclides.
Radioactivity	The property possessed by some elements (i.e., uranium) of spontaneously emitting alpha, beta, or gamma rays by the disintegration of atomic nuclei.
Radiocolloid	Colloids, or colloidal systems, containing radionuclides.
Radiolysis	Chemical decomposition by the action of radiation.
Radionuclide	Radioactive type of atom with an unstable nucleus that spontaneously decays, usually emitting ionizing radiation in the process. Radioactive elements characterized by their atomic mass and number.
Random Variable	See Section A.2 of this glossary.
Range (Statistics)	See Section A.2 of this glossary.
REACT Computer Code	The reaction mass transfer code.
Reaction Kinetics	The study of the rates and mechanisms of chemical reactions.
Reaction Rate	The rate at which a chemical reaction takes place.
Realization	A complete calculation using a randomly selected value. Many of these calculations are done in a Monte Carlo analysis.
Recharge	The movement of water from the unsaturated zone to the saturated zone.

Reducing Conditions	With regard to criticality, the important aspect of reducing conditions is that they reduce the oxidation state of materials (deoxidize), and the material that is reduced becomes less soluble. Radionuclides being transported in groundwater can precipitate out and collect in an area of reducing conditions. With regard to corrosion, reducing conditions slow corrosion, because oxygen is less available, or not available, to combine with the iron and form rust.
Reference Person	With regard to dose, a hypothetical collection of human physical and physiological characteristics arrived at by international consensus. This collection may be used by researchers to relate biological damage to a stimulus such as radiation exposure. The reference adult person lives 20 km (12 miles) from Yucca Mountain and will be defined using a survey of the existing population.
Reflux Water	Water that is vaporized near waste packages, migrates to cooler areas, condenses, and then flows back toward the waste packages.
Regression Analysis	See Section A.2 of this glossary.
Relative Permeability	The permeability of rock material to a given substance compared to the absolute (total) permeability of the rock. The term is usually used to signify the permeability to one fluid when two or more fluids are present in the rock.
rem	The unit of a dose equivalent from ionizing radiation to the human body. It is used to measure the amount of radiation to which a person has been exposed) (rem means roentgen equivalent man).
Repository Layout	The host rock, depth, and areal extent of the repository facility, drift size and spacing, mechanical support system, thermal load, and ventilation system used during the operational phase of the facility. This is as mentioned in the Energy and Water Appropriations Act of 1997.
Repository Safety Strategy	A document used to assist management in prioritizing testing and analysis activities to focus on the most important issues in postclosure safety. Identification of the important issues allows resource use (e.g., sampling and testing activities) to be focused on gathering information that will reduce the uncertainty in parameters and processes related to the key issues. Key elements of the document include the following: (1) Limited water contacting waste packages (2) Long waste package lifetime (3) Low rate of release of radionuclides from breached waste packages (4) Radionuclide concentration reduction during transport from the waste packages

Retardation	Slowing or stopping of radionuclide movement in groundwater by mechanisms that include sorption of radionuclides, diffusion into rock matrix pores and microfractures, and trapping of large colloidal molecules in small pore spaces or dead ends of microfractures.
RIP Computer Program	RIP is an initialism for repository integration program, the executive TSPA "driver" program. An integrating software code into which simplified analytical expressions, or callable subroutines describing the behavior of the different components, can be placed. RIP sequentially advances through time while keeping track of the changes in environments and the fate of the radioactive constituents within the engineered and natural barriers.
Risk	The probability that an undesirable event will occur multiplied by the consequences of the undesirable event.
Risk Assessment	An evaluation of potential consequences or hazards that might be the outcome of an action. This assessment focuses on potential negative impacts on human health or the environment.
Rock Matrix	See Matrix.
Salt Deposit Effect	(1) Potential buildup of salt scales on the waste package surface from water dripping onto the waste package while its surface is at elevated temperatures. (2) The development of potentially aggressive conditions to the waste package corrosion degradation under and around the salt deposits by providing a wetter environment than the surroundings and causing concentration of aggressive species in the local salt solution.
Saturated Zone	The region below the water table where rock pores and fractures are completely saturated with groundwater.
Scenario	A well-defined, connected sequence of features, events and processes that can be thought of as an outline of a possible future condition of the repository system. Scenarios can be undisturbed, in which case the performance would be expected, or nominal, behavior for the system. The scenario can also be disturbed, if altered by disruptive events such as human intrusion, natural phenomena such as volcanism, or nuclear criticality.
Secondary Phase	Occurs when spent nuclear fuel is contacted by water and dissolves, forming uranyl minerals. The major secondary phase minerals are schoepite, uranophane, Na-boltwoodite, and soddyite.
Seepage	The inflow of groundwater moving in fractures or pore spaces of permeable rock to an open space in the rock such as a drift. Specifically, the amount of percolation flux that enters the drift in a given time period. An important factor in waste package degradation and mobilization and migration of radionuclides out of the repository.

Seepage Fraction	The fraction of the total number of waste packages that is contacted by drips from seepage into the drifts.
Seismic	Pertaining to, characteristic of, or produced by earthquakes or earth vibrations.
Sensitivity Study (Analysis)	An analytic or numerical technique for examining the effects of varying specified parameters when a model run is performed. Shows the effects that changes in various parameters have on model outcomes and can illustrate which parameters have a greater impact on the predicted behavior of the system being modeled. Also, called sensitivity analysis because it shows the sensitivity of the consequences (e.g., radionuclide release) to uncertain parameters (e.g., the infiltration rate that results from precipitation).
Simulation	The generation of a sample set by selecting a parameter value from each input distribution and calculating the consequences for the sample set. See also Realization.
Single Heater Test	A field test in the Exploratory Studies Facility that uses a single heated element emplaced directly into Yucca Mountain tuff (Topopah Spring Middle Nonlithophysal hydrogeologic unit). The test is designed to determine the thermal-hydrologic responses of the unit to heating.
Site Characterization Plan	The plan that contains the strategy for completing a detailed set of activities that was expected to provide all of the information needed to comprehensively describe the repository system. The plan also documented methods for assessing the performance of the total repository system and its individual components. This was published by the U.S. Department of Energy in 1988 with subsequent updating ongoing.
Site Recommendation	A recommendation by the Secretary of Energy to the President that the Yucca Mountain site be approved for development as the nation's first high-level radioactive waste repository. If the site is determined to be suitable, this recommendation is expected in fiscal year 2001.
Smeared Heat Source	An attribute of mountain-scale thermal hydrology models in which the model handles heat output for waste packages by using the total heat produced by all assemblies in all waste packages, arrives at the entire repository-wide thermal load, and averages the thermal load across the entire repository heat area (~740 acres).
Sorb	To undergo a process of sorption.

Sorption	The binding, on a microscopic scale, of one substance to another. A term which includes both adsorption and absorption. The sorption of dissolved radionuclides onto aquifer solids or waste package materials by means of close-range chemical or physical forces is an important process modeled in this study. Sorption is a function of the chemistry of the radioisotopes, the fluid in which they are carried, and the mineral material they encounter along the flow path.
Sorption Coefficient (K_d)	Coefficient for a term for the various processes by which one substance binds to another.
Source Term	Types and amounts of radionuclides that are the source of a potential release from the repository.
Spalling	Flaking off of corrosion products from the metal substrate as it undergoes corrosion. The layer of corroded material thickens. The spalling could be caused by an expansive action of the corrosion products because they occupy a greater volume than the uncorroded metal substrate.
Spatial Variability	A measure of how a property, such as rock permeability, varies in an object such as a rock formation.
Speciation	The existence of the elements, such as radionuclides, in different molecular forms in the aqueous phase.
Spent Nuclear Fuel	Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated by reprocessing. Spent fuel that has been burned (irradiated) in a reactor to the extent that it no longer makes an efficient contribution to a nuclear chain reaction. This fuel is more radioactive than it was before irradiation, and it is hot. See also Burnup.
Steady-State Modeling	Modeling a system under the assumption that the variables are not changing with time. For example, flow fields can be simulated at a steady state if the boundary conditions, saturations, and fluxes are not changing with time.
Stream Tube	A modeling method used to represent the groundwater flow path from the water table to the biosphere. There are six stream tubes used for saturated zone modeling with one tube associated with and having the cross-sectional shape of, one of six regions designated at the water table. Each stream tube takes in groundwater flux and radionuclide mass flux data at the water table representing flux from the repository that has gone through the unsaturated zone.

Stochastic	Involving a variable (e.g., temperature and porosity) that may take on values of a specified set with a certain probability. Data from a stochastic process is an ordered set of observations, each of which is one item from a probability distribution. Random.
Stochastic Model	A model whose outputs are predictable only in a statistical sense. A given set of model inputs produces outputs that are not the same, but follow statistical patterns.
Stratigraphy	The branch of geology that deals with the definition and interpretation of the rock strata, the conditions of their formation, character, arrangement, sequence, age, distribution, and especially their correlation by the use of fossils and other means of identification.
Stress Corrosion Cracking	A cracking process that requires the simultaneous action of a corrosion mechanism and sustained tensile stress.
Structural Failure	Loss of waste package integrity to contain radionuclides.
Structure	In geology, the arrangement of the parts of the geologic feature or area of interest such as folds or faults. Structural features develop as a result of stresses that cause movements of the earth's crust and result in events such as earthquakes as the crust deforms.
Superpluvial Climate	One of three sets of conditions used to represent climate changes through time. Representative of wetter-than-normal climate conditions at Yucca Mountain, with precipitation three times that of the present-day climate. See also Dry Climate and Long-Term-Average Climate.
Surface Complexation	The process that describes the formation of complex molecules between the solute in the aqueous phase and the reactive groups on the solid surface, under specific chemical conditions.
Surrogate	Using one thing in place of another. An example is using a single important parameter, radionuclide travel time, as a surrogate for performance when the actual performance measure takes into account the effects of many factors. If the calculated travel time of radionuclides of interest is fast, that implies that performance of the natural and engineered barriers in containing the radionuclides is not as effective as it would be if radionuclide travel time was slow.
Tectonic	Pertaining to geologic forms or effects created by deformation of the earth's crust.
Tectonism	A general term for all movement of the earth's crust produced by tectonic processes.
Temperature Gradient	The rate of change of temperature with distance. When applied to the earth, the term geothermal gradient may be used.

Thermal-Chemical	Relating to thermal chemistry, the chemistry branch that studies heat changes that accompany chemical reactions and changes of state.
Thermal Conduction	The flow of thermal energy through a material. This conduction is affected by the amount of heat energy present, the nature of the heat carrier in the material, and the amount of dissipation.
Thermal-Hydrologic	Of or pertaining to changes in groundwater movement due to the effects of changes in temperature.
Thermal-Hydrologic Processes	Processes that are driven by a combination of thermal and hydrologic factors. These processes include evaporation of water near the repository when it is hot and subsequent redistribution of fluids by convection, condensation, and drainage.
Thermal Hydrology	The study of a system that has both thermal and hydrologic processes. A thermal-hydrologic condition, or system, is expected to occur if heat-generating waste packages are placed in the repository at Yucca Mountain.
Thermal Loading	The application of heat to a system, usually measured in terms of watt density. The thermal loading for a repository is the watts per acre produced by the radioactive waste in the active disposal area. The spatial density at which waste packages are emplaced within the repository as characterized by the areal power density and the areal mass loading.
Thermal Period	The time period in which thermal effects, such as higher temperatures or dried rock, are present in the region surrounding the repository.
Thermal Power Per Waste Package	The rate of heat released in watts by a particular waste package type. This will vary with fuel type and age, waste package capacity, and disposal configurations within waste packages.
Thermodynamic	Pertaining to the mechanical action of heat.
Thermodynamic/Kinetic Coefficients	Numbers that represent the rate of heat flow through a porous medium. An example is a coefficient that represents the rate of heat flow in a given type of rock.
Three-Dimensional Model	A three-dimensional representation of physical conditions and/or processes.
Time History	The predicted response of a system, expressed as a function of simulation time.
TOSPAC Computer Code	A computer code that simulates one-dimensional groundwater flow with the transport of decaying contaminants in partially saturated, fractured media.

Total Effective Dose Equivalent	The sum of the deep-dose equivalent, for external exposures, and the committed effective dose equivalent, for internal exposures.
Total System Performance Assessment (TSPA)	A risk assessment that quantitatively estimates how the proposed Yucca Mountain repository system will perform in the future under the influence of specific features, events, and processes, incorporating uncertainty in the models and data. Its purposes follow: (1) provide the basis for predicting system behavior and testing that behavior against safety measures in the form of regulatory standards (2) provide the results of TSPA analyses and sensitivity studies (3) provide guidance to site characterization and repository design activities (4) help prioritize testing and selection of the most effective design options.
TOUGH2 Computer Code	A computer program that simulates three-dimensional flow of groundwater and heat in unsaturated and saturated porous and fractured media. The code name is derived from Transport of Unsaturated Groundwater and Heat.
Toxicity	The ability of a substance to cause damage to cells or tissues of living organisms when the substance is inhaled, ingested, or absorbed by the skin. Acute toxicity is that which occurs over a short term of exposure, and chronic toxicity is that which occurs over a long term of exposure.
Tracer Testing	A procedure in which a soluble substance (tracer) is added to groundwater at one location, and its movement to another location is observed. Tracer testing is a technique by which groundwater flow directions and velocities and other hydrologic properties of rocks can be estimated.
Transient	Describing a variable that is changing with time. This occurs before development of a steady state condition.
Transient Modeling	Modeling of a system in which the variables are changing through time. Heating of the repository by the waste is a transient condition for which transient modeling is done.
Transparency	According to the Nuclear Waste Technical Review Board, the ease of understanding the process by which a study was carried out, which assumptions are driving the results, how they were arrived at, and the rigor of the analyses leading to the results. According to a Peer Review Panel report, transparency "requires ensuring completeness and using a logical structure that facilitates in-depth review of the relevant issues...achieved when a reader or reviewer has a clear picture of what was done in the analysis, what the outcome was, and why."

Transpiration	The process in which water enters a plant through its root system, passes through its vascular system, and is released into the atmosphere through openings in its outer covering. It is an important process for removal of water that has infiltrated below the zone where it could be removed by evaporation.
Transport	A process in which substances carried in groundwater move through the subsurface by means of the physical mechanisms of convection, diffusion, and dispersion and the chemical mechanisms of sorption, leaching, precipitation, dissolution, and complexation. Types of transport include advective, diffusive, and colloidal transport.
Transverse Dispersion	Dispersion of a solute moving in groundwater in directions transverse to the direction of the groundwater flow path. This movement may also be called lateral dispersion.
Tritium	A radioactive isotope of hydrogen that can be taken into the body easily, because it is chemically identical to natural hydrogen. Tritium decays by beta emission with a half-life of about 12.5 years.
TSPA Peer Review Panel	See Peer Review Panel.
Tuff	Igneous rock formed from compacted volcanic fragments from pyroclastic (explosively ejected) flows with particles generally smaller than 4 mm (0.16 in.) in diameter. The most abundant type of rock at the Yucca Mountain site.
Tuffaceous	A general term referring to any rock containing tuff.
Two-Dimensional Model	A two-dimensional slice through an entity, such as the earth's crust, usually in the horizontal and vertical directions, on which known features are placed and are used to predict likely features that may exist between points of known data. Mathematically, a model that represents physical conditions and/or processes; this mathematical model is composed of both horizontal rows and vertical columns of grid cells arrayed in L-shaped configurations only one grid cell thick. Also called a cross section.
Uncertainty	A measure of how much a calculated or estimated value that is used as a reasonable guess or prediction may vary from the unknown true value.
Undisturbed Performance	Refers to the expected or nominal behavior of the system as perturbed only by the presence of the repository. This is as used in description of scenarios, or features, events, or processes making up scenarios.

Unsaturated Zone	The zone of soil or rock below the ground surface and above the water table in which the pore spaces contain water, air, and other gases. Generally, the water saturation is below 100 percent in this zone, although areally limited perched water bodies (having 100 percent water saturation) may exist in the unsaturated zone. Also called the vadose zone.
Unsaturated Zone Flow	The flow of water in the unsaturated zone by downward percolation and by capillary action.
Unsaturated Zone Radionuclide Transport Model	A computer software code that defines the movement of radionuclides from the edge of the engineered barrier system, through the unsaturated zone, and to the boundary of the saturated zone.
Vadose Zone	See Unsaturated Zone.
Variable	See Section A.2 of this glossary.
Variability (Statistical)	A measure of how a quantity varies over time or space.
Velocity Field	The velocities of fluid flow, gas or liquid, in a region, which are generally depicted by arrows to indicate the direction and magnitude of the velocity.
Vitrified	Pertaining to a type of processed high-level radioactive waste where the waste is mixed with glass-forming chemicals and put through a melting process. The melted mixture is then put into a canister where it becomes a dry "log" of waste in a glassy matrix.
Vitrified Defense High-Level Radioactive Waste	A type of processed defense high-level radioactive waste that has been contained in a glass matrix.
Volcanism	Pertaining to volcanic activity.
WAPDEG Computer Code	A computer software code that was developed to model long-term corrosion degradation of waste disposal containers in the repository.

Waste Containment and Isolation Strategy	A document designed to assist the project management in prioritizing testing and analysis activities to focus on the most important issues in postclosure safety. It is also designed to help resolve uncertainty in processes and parameters of greatest significance to long-term performance. The document is still evolving. The key elements include the following: (1) Low groundwater flow amounts through storage area (2) Long-lived waste packaging (3) Cladding on the waste and low water content in waste to slow degradation (4) Engineered systems that promote slow dispersion/migration of radionuclides (5) Natural systems that promote slow dispersion/migration of radionuclides
Waste Form	A generic term that refers to radioactive materials and any encapsulating or stabilizing matrix.
Waste Package	The waste form and any containers (i.e., disposal container barriers and other canisters), spacing structures or baskets, shielding integral to the container, packing contained within the container, and other absorbent materials immediately surrounding an individual waste container placed internally to the container or attached to the outer surface of the disposal container. The waste package begins its existence when the outer lid welds are complete and accepted.
Waste Package Design Organization	The management and oversight department responsible for the waste package design and testing.
Waste Stream	Input of waste into the repository over time.
Water Flux	See Flux.
Water Table	The upper surface of a zone of saturation above which the majority of pore spaces and fracture openings are less than 100 percent saturated with water most of the time (unsaturated zone), and below which the opposite is true (saturated zone).
Weeps Model	A stochastic conceptual model of groundwater flow through fractured rock. The flow is assumed to occur through stochastically generated fracture paths, or weeps, with no interaction occurring between fracture and matrix.
Welded	Fused.
Welded Tuff	A tuff that was deposited under conditions where the particles making up the rock were heated sufficiently to cohere. In contrast to nonwelded tuff, welded tuff is considered to be denser, less porous, and more likely to be fractured (which increases permeability).

Young Spent Fuel, Old Spent Fuel	Terms used to designate groups of commercial spent nuclear fuels by their age since discharge from the power reactor. The young spent nuclear fuels are characterized by higher radiation levels and resulting higher heat outputs than the old spent nuclear fuels.
Yucca Mountain Waste Containment and Isolation Strategy	See Waste Containment and Isolation Strategy.
Zeolites	A large group of hydrous aluminosilicate minerals that act as molecular "sieves" because they can adsorb molecules with which they interact. At Yucca Mountain, they are secondary alteration products in tuff rocks when the rocks are exposed to groundwater and could act to retard the migration of radionuclides by their sieving action.
Zircaloy	An alloy material that may have any of several compositions including zirconium oxide. It is used as a cladding material.

A.2 GLOSSARY OF STATISTICS TERMS

Terms in this section are presented separately from the general glossary in Section A.1 because many of the statistical terms are defined in relation to other statistical terms. The terms are numbered to allow reference from the general glossary in Section A.1.

Coefficient of Multiple Determination	A measure of goodness of fit of a linear-regression model; a value near 1 indicates a good fit, meaning that the model is accounting for most of the uncertainty in the performance measure being analyzed.
Complementary Cumulative Distribution Function	A method of depicting the probability that a performance measure, such as dose, exceeds a given value. For most measures, the higher the value, the lower the probability.
Confidence	In statistics, a measure of how close the estimated value of a random variable is to its true value.
Confidence Interval	An interval that is believed, with a preassigned degree of confidence, to include the particular value of the random variable that is estimated.
Continuous Random Variable	Those variables whose value is determined by taking measurements and that can take <u>any</u> value of an infinite number of possible values within a certain value range. The concentration of radionuclides in water is a continuous random variable and, although ranging from zero to a value limited by the solubility of an individual radionuclide under given conditions, possible outcomes of dissolving a given radionuclide in water cannot be represented by a finite number of discrete values. This type of variable has a probability density function.

Correlation Coefficient	A coefficient (designated r) calculated in the analysis of paired data when neither of the variables can be singled out as of prior importance to the other and the study seeks to analyze their interdependence, as opposed to the dependence of one upon the other. This term is a dimensionless quantity that can be used (with certain reservations) as an absolute measure of the relationship between two variables. Mathematically, for two random variables, the ratio of their covariance to the product of their standard deviations. The correlation coefficient is also a measure of how close a scatter plot of points produced by one variable plotted against the other comes to falling on a straight line drawn through the trend of the points. In a negative correlation between the two variables, larger values of one are associated with smaller values of the other. In a positive correlation, larger values of one variable are associated with larger values of the other.
Covariance	For a pair of random variables, the expected value of the product of the deviations from their respective means. It measures the extent to which two variables vary together and if the variables are independent the covariance is zero (so is the correlation coefficient). If large values of one variable are associated with large values of the other, the covariance is positive, while if small values of one are associated with large values of another, the covariance is negative. The covariance is usually calculated to find the correlation coefficient.
Cumulative Distribution	For grouped data, a distribution that shows how many of the values are less than or more than specified values. For random variables this term is synonymous with distribution function.
Cumulative Distribution Function	For a continuous random variable, a function that quantifies the probability that the variable is no greater than any specified value of interest. The derivative of the cumulative distribution function is the probability density function. The cumulative distribution function is most commonly used to analyze continuous variables when data are not divided into categories (grouping by some qualitative description), and the probability density function is more appropriate when categorical studies of continuous random variables are performed.
Cumulative Probability	The probability that a random variable will have a value equal to or less than some specified value.
Dependent Variable	A variable whose value depends on one or more other variables. For example, the value (amount) of body weight is a variable that depends on several independent variables—the amount of calories taken in and the amount of calories burned, as well as genetics and probably other factors. As another example, the thermal load per acre of the repository is a dependent variable—it depends on the type, number, and spacing of waste packages emplaced.

Discrete Random Variables	Those variables whose values are finite, or countable in numbers. The number of waste packages of each type is a discrete variable. Discrete random variables have associated with them probability functions that tell the probability that the variable takes on any particular value. For example, in throws of two unbiased dice, the probability that the value of the numbers shown on the dice (a discrete random variable) for any throw will be two is one in 36; the probability function is 1/36.
Distribution	The overall scatter of values for a set of observed data. A term used synonymously with frequency distribution. Distributions have probability structures that are the probability that a given value occurs in the set.
Distribution Frequency	A representation of how values of an outcome or variable are distributed over the range of expected values.
Distribution Function	A function whose values are the probabilities that a random variable assumes a value less than or equal to a specified value. Synonymous with cumulative distribution.
Expected Value	A variable's mean, or average, outcome. The weighted average of the number of possible outcomes, with each outcome being weighted by its probability of occurrence. The mean of a probability distribution of a random variable that one would expect to find in a very large, random sample. The sum of the possible values, each weighted by its probability—the center of the random variable's histogram (frequency distribution).
Frequency Distribution	Formed when data are grouped into classes (or ranges of values within the overall set of values, such as 1 to 5, 5 to 10, 10 to 20, etc.), with the classes listed in a table (or other format) showing the number of data points that occur in each class.
Function (Mathematics)	A quantity that is variable and whose value depends on and varies with the value of another quantity or quantities. Functions show the mathematical relationship between dependent variables and the independent variables upon which the value of the dependent variables depend.
Histogram	A bar graph representation of a frequency distribution having frequency of occurrence as the ordinate (y axis) and classes of values observed in sampling of the variable as the abscissa (x axis). The area of each rectangle in the histogram represents the proportion of observations (relative frequency) that fall in that interval. This is the relative frequency of observations that lie between the two values that form the class boundary. It is not for a single value but is relative frequency of the class interval.
Linear Correlation	The relationship between two or more random variables for which the regression equations are linear.

Linear Regression	A regression where the relationship between the (conditional) mean of a random variable and one or more independent variables can be expressed by the mathematical equation that describes a line. A relationship between two variables such that the dependence of one variable on the other can be described by (the equation of) a straight line.
Linear Stepwise Regression	An analysis designed to determine variables that have the greatest influence on an output value (e.g., peak dose rate) when there are many variables whose input values go into the calculation. In simple terms, a linear regression is performed for a line in a multidimensional space, and the correlation of the values of different variables to the line are examined by performing the calculation multiple times and varying the value of one variable at a time while holding the others constant. This is a stepwise process in which one variable at a time is examined to determine the impact of its influence on the final outcome (peak dose rate, for instance).
Mean (Arithmetic)	For a statistical data set, the sum of the values divided by the number of items in the set. The arithmetic average.
Mode	A measure of location in a data set defined as the value which occurs with the highest frequency. For qualitative data it is the attribute which occurs most frequently. A set of data or a distribution can have more than one mode, or if no two values are alike, no mode. For the distribution of a random variable the mode is the value for which the probability function or probability density is at the relative maximum.
Monte Carlo (Uncertainty) Analysis	An analytical method that uses random sampling of parameter values available for input into numerical models as a means of approximating the uncertainty in the process being modeled. A Monte Carlo simulation comprises many individual runs of the complete calculation using different values for the parameters of interest as sampled from a probability distribution. A different final outcome for each individual calculation and each individual run of the calculation is called a realization. Each realization is equally likely to occur in the Monte Carlo process.
Percentile	For a large data set where specific values are not repeated extensively, used to indicate where a value lies in relation to the entire group of values. For example, the 25th percentile indicates that about 25 percent of the items are smaller than this value and about 75 percent are larger than this value.
Probability	The relative frequency with which an event occurs in the long run. Statistical probability is about what really happens in the real world and can be verified by observation or sampling. Knowing the exact probability of an event is usually limited by the inability to know, or compile the complete set of, all possible outcomes over time or space.

Probability-Density Function	A frequency distribution such that the bars of a histogram that would represent it are so narrow that their tops would form a smooth curve if connected by a line. The curve is the probability density function. This type of distribution can be made if the number of observations of the value of a continuous random variable increases indefinitely, and the width of the range represented by each class (class interval) becomes smaller and smaller. The area under the density function curve between any two points on the curve, such as x_1 and x_2, represents the probability that the value of the random variable will lie between these two values.
Probability Distribution	The set of outcomes (values) and their corresponding probabilities for a random variable.
Quantile	A value at or below which lies a given fraction (1/5, 30 percent, etc.) of a set of data. Also called fractile.
R^2	A correlation coefficient that quantifies the goodness of fit of a linear regression model to an output value such as peak dose rate. A value of one corresponds to a perfect fit.
R^2 - Loss	The amount of change in fit when a variable is dropped from a linear stepwise regression analysis. For example, look at a linear stepwise regression analysis such that the out put (e.g., dose) is calculated using 10 variables and the total R^2 is 0.80 (1 corresponds to a perfect fit). If the analysis is then performed with one of the variables left out and the R^2 is 0.78 (meaning it changed or lost very little), then that variable does not contribute strongly to the fit. If the loss is large such as going from 0.80 to 0.60, then the variable does contribute strongly to the fit. This is a method of showing to which variables the outcome (peak dose) is most sensitive or responsive.
Random Variable	A property that has a numerical description and is determined by the outcome of a random experiment or random sampling. The different values of the random variable have different probabilities of occurrence. Also called variates.
Range (Statistics)	The numerical difference between the highest and lowest value in any series.
Rank Transformation	A type of data transformation used either to reduce the influence of extreme values or to deal with non-linearities in data sets. Data will fit better to a non-linear curve if it is first put into ranks. In ranking, the data values of both input and input data are replaced with the rank of that data value within the data set. The smallest value of a data set is replaced with the number 1, the second smallest is replaced with the number 2, and so forth up to the largest value in the set.

Regression	The relationship between the (conditional) mean of a random variable and one or more independent variables.
Regression Analysis	The analysis of paired data such that one member of the pair is a constant and the other is a random variable. The analysis of a paired dependent variable and the independent variable upon which it depends. For example, the term was first used in a study of the heights of fathers and sons where a regression (or turning back) was observed toward the mean height of the population in the heights of sons whose fathers were taller or shorter than the mean.
Scatter Plot	(1) A set of points arrived at by plotting paired values as points in a plane. (2) A two-dimensional dot plot.
Standard Deviation	(1) For a set of observations or a frequency distribution, the square root of the average of the squared deviations from the mean divided by n-1 (where n is the sample size). (2) The square root of the variance.
Variable	A nonunique property or attribute.
Variance	(1) The square of the standard deviation. (2) The expected squared distance from the population mean of a random variable, sometimes called the population variance.

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